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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/008.531 01/16/98 RHODES

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EXAMINER

MMC1/0718

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ART UNIT

PAPER NUMBER

2823

DATE MAILED:

07/18/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/008,531

Applicant(s)

RHODES, HOWARD E.

Examiner

Kurt M. Eaton

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-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 April 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-32, 35, 36, 40-43, 47 and 48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-32, 35, 36, 40-43 and 48 is/are rejected.
- 7) ☒ Claim(s) 48 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4/30/01 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 26 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 26 recites the limitation "wherein said overetch amount is an amount necessary to account for variations in forming said first layer of material and said first layer of said first conductive material". The amount of the layer of the first conductive material which communicates with layer of the first layer of conductive material is overetched is defined as being "an amount necessary to account for variations in forming said first layer of material and said first layer of said first conductive material". Claim 26 does not distinctly claim what the overetched amount is because the claim does not reasonably appraise one of ordinary skill in the art what type of "variations" are encountered.

Claim Objections

4. Claim 48 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 21-25, 31, 32, 40-43, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuo in view of Wolf.

In re claims 21, 31, 40, and 47, Matsuo shows in Figures 2A-2E and related text, a process for making a semiconductor device including the steps of providing a substrate having at least one semiconductor layer (1); forming an underlayer (21) over the at least one semiconductor layer; forming a layer of conductive material (12) having a first thickness over the underlayer having a topography that includes a substantially vertical component and a thick region, wherein the thick region has a second thickness greater than the first thickness; forming an overlayer (23) over the layer of the conductive material; forming a contact in the overlayer such that it is formed through the overlayer and physically in contact with the thick region; and forming a structure (13) in the contact disposed adjacent to and contacting the vertical component. Matsuo also shows wherein

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contacts may be formed using an etching technique {see Figure 2B; column 5, lines 30-46}. Matsuo further shows in Figure 2B wherein the overlayer is made of oxide material and wherein the layer of conductive material is made of polysilicon {column 3, line 59 – column 5, line 55}.

Matsuo fails to show wherein the contact formed in the overlayer is formed by etching; or wherein, during the step of etching the contact in the overlayer, etching in an overetch amount of the substantially vertical component such that the contact is formed in the vertical component and in the thick region.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the contact in the overlayer of Matsuo using an etching technique since Matsuo discloses that contact holes are formed by a well known technique including an etching process and the selection of a known contact formation process on the basis of its suitability for the intended use involves only routine skill in the art.

Matsuo fails to show wherein, during the step of etching the contact in the overlayer, etching in an overetch amount of the substantially vertical component such that the contact is formed in the vertical component and in the thick region.

Wolf teaches that oxide may be etched selectively to polysilicon material. Wolf also teaches that, even though the oxide material is etched selectively to polysilicon material, some tolerable amount of polysilicon material is etched as well {pages 547-54}.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the contact in the overlayer of Matsuo using an oxide etching treatment as in Wolf since the oxide etching treatment of Wolf would have enabled practitioners of Matsuo to form the contacts in the overlayer, thereby enabling the function of the device to be realized. It also would have been obvious, given the teaching of Wolf, that the layer of conductive material of Matsuo

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would have been etched to some degree (i.e., an overetch amount) such that the contact was formed also in the vertical component and in the thick region since, even though overlayer material may be etched selectively to the layer of conductive material, the layer of conductive material will still be etched by some tolerable amount (i.e., an overetch amount). In light of the above, it would have been obvious that the substantially vertical component of Matsuo in view of Wolf would have been overetched by an amount such that the contact would have been formed in the vertical component and in the thick region.

In re claims 22 and 32, Matsuo shows wherein the vertical component defines a localized thick region in the layer of conductive material {see Figure 2B}.

In re claim 23, Matsuo shows wherein the vertical component is a spacer {see Figure 2B}.

In re claim 24, Matsuo further includes the step of forming a structure (21) having an opening therein under the conductive layer and filling the opening with the conductive material to form the vertical component {see Figure 2B}.

In re claim 25, Matsuo shows wherein the contact disposed adjacent to and contacting the vertical component is a capacitor electrode made of the same material as the layer of conductive material {column 4, lines 3-22}.

Matsuo in view of Wolf fails to show wherein the layer of conductive material is a capacitor electrode.

It would have been obvious to one of ordinary skill in the art at the time the invention was made that the layer of conductive material and the contact, which is a capacitor electrode, of Matsuo in view of Wolf were in electrical contact with each other. Accordingly, it would have been obvious that the layer of conductive material of Matsuo could have been considered a part of the capacitor

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electrode since, as far as the function of a capacitor electrode is concerned, there exists no electrical boundary between the layer of conductive material and the contact.

In re claim 41, Matsuo shows wherein forming a conductive layer having a thick region includes forming a layer of conductive material having a thick region having a width greater than other portions of the conductive layer {see Figure 2B}.

In re claim 42, Matsuo shows wherein forming a conductive layer having a thick region includes forming a layer of conductive material having a thick region having a width greater than other portions of the conductive layer and a depth extending below the other portions of the conductive layer {see Figure 2B}.

In re claim 43, Matsuo in view of Wolf does not show wherein forming the contact includes etching a tolerable amount of the thick region and forming the contact physically in contact with the thick region at a depth deeper than an upper surface of the thick region.

It would have been obvious, given the teaching of Wolf, that the layer of conductive material of Matsuo would have been etched to some degree since, even though oxide material may be etched selectively to polysilicon, polysilicon material will still be etched by some tolerable amount. Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the contact formed physically in contact with the thick region of Matsuo would have contacted the thick region at a depth deeper than an upper surface of the thick region.

7. Claims 26-28, 30, 35, 36, 47 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bergemont.

In re claims 26 and 35, Bergemont shows in Figures 10 and 12-14 a process for making a semiconductor device having an improved contact to a conductive layer including the steps of providing a first layer of material (118) and forming an opening therein, wherein the opening

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includes sidewalls (119); forming a layer of a first conductive material (122) on the first layer of material and along the surfaces of the sidewalls of the opening to form a localized thick region; forming an overlayer of material (124) on the layer of the first conductive material; forming a contact hole in the overlayer of material on the layer of the first conductive material; and substantially filling the contact hole in the overlayer with a second conductive material (126) which differs in composition from the first conductive layer and which contacts the first conductive material {column 8, line 56 – column 10, line 9}.

Bergemont does not show wherein, during the step of etching the contact hole in the overlayer, forming the contact hole which communicates in the localized thick region by overetching an amount of the layer of the first conductive material which communicates with the layer of the first conductive material, wherein the overetch amount is an amount necessary to account for variations.

It would have been obvious to one of ordinary skill in the art that no etchant used to etch the overlayer material of Bergemont selectively with respect to the first conductive material of Bergemont is capable of being completely selective (i.e., wherein one material is selectively etched while another material, exposed to the same etchant is absolutely not etched). Even if the etch selectivity of one material to another is 1,000,000 : 1, the material that etches at a slower rate will still be etched an amount. Accordingly, it would have been obvious that, during the step of etching the contact hole, the layer of the first conductive material which communicates with the layer of the first conductive material would have also been etched (i.e., overetched), thereby forming the contact hole which communicates with the layer of the first conductive material in the localized thick region, by an amount and that that overetch amount would have been an amount dictated by the variations in the etch selectivity characteristics of the two materials with respect to the etchant used.

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In re claim 27, Bergemont shows where the first conductive material forms spacers on the sidewalls of the opening {see Figure 13}.

In re claim 28, Bergemont shows where the second conductive material contacts at least the spacers {see Figure 14}.

In re claims 30 and 36, Bergemont shows where the first layer and the overlayer include insulating materials {column 8, line 56 – column 10, line 9}.

8. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bergemont in view of Chiang.

In re claim 29, Bergemont shows where the first conductive material includes TiN that serves as an interconnect structure and the second conductive material includes a metal that is not TiN {column 8, line 56 – column 10, line 9}.

Bergemont does not show wherein the first conductive material includes polysilicon.

Chiang teaches that polysilicon and TiN materials may be used as equivalent materials in formation of interconnect structures {column 6, lines 48-60}.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the first conductive material of Bergemont using polysilicon instead of TiN since, as evidenced by Chiang, polysilicon and TiN are well known materials that may be used to form interconnect structures and the selection of a known material on the basis of its suitability for its intended use involves only routine skill in the art.


Conclusion

9. Paper related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in

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Crystal Plaza 4, room 4C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 308-7722** or **-7724**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication of earlier communication from the examiner should be directed to **Kurt Eaton** at **(703) 305-0383** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via kurt.eaton@uspto.gov.



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